



## Goddard Space Flight Center 2009 Sample Student Projects

### Required Academic Level

Freshman/Sophomore  
Undergraduate, Junior/Senior  
Undergraduate

### Category

*Computer & Info. Sci*

### Subcategory

*High Performance Computing*

### Project Title

***MatLab Parallel Interface-based (MPI) Parallel Architecture Software Engineer***

### Project Description

The prospect student will assist the researcher to migrate the Propagator program to parallel architecture clusters. In this process, the current propagator developed in Matlab will be ported to C/C++ language on Linux based computer. The major part of the program involve migration of Fast Fourier Transform routine into parallel architecture system. For this purpose, the student will learn the parallel architecture paradigms, FFTw libraries, and MPI-based programming language. He/She will learn to run the Propagator on Matlab and obtain the required results for a small scale problem. Then he/she experiments with the FFTw running on a cluster system and rewrite the Propagator program in C/C++ using FFTw routines on Linux system. After completion of this process, he/she will port the code to MPI-based FFTw on a cluster. Emphasis will be placed on obtaining the correct results from C/C++ program and validate the output to Matlab based program. In addition to porting, the migrated code will be optimized in performance, memory, and data processing aspects on a parallel architecture. The completed project will enable the Propagator to run on NCCS Discover system. Upon completion of this project, he/she would be expected to work on porting of numerical integration programs to parallel architecture system. Similar to FFTw process, the numerical code will be ported to a MPI-based system on Linux server.

### Mentor's Expectation of Student

He/She would be to learn the MPI-based language. Understand and follow the Propagator program. Familiarity with Linux operating system. Install, setup and utilize the FFTw in applied application both in serial and parallel mode. Learn optimizing MPI-based programs to obtain better performance. Complete the migration of Propagator from Matlab to MPI-based program. Successfully validate the output from the parallel code to the Matlab output.

### Discipline of Project and/or Background Needed to successfully complete the project

Astronomy: Astrophysics; Software Engng; Computer Science; Physics

### Skills

Analysis, Research, Teamwork, Linux/Unix, Macintosh, Windows, C, C++